**Chemistry-I Curriculum** (updated January 25, 2013)

**Unit One: Introduction to Chemistry, Lab Safety and Procedures** **(Textbook Chapters 1 and 2 and Keynote Unit 1)**

**Key Terms/Vocabulary:**

Chemistry, inorganic, organic, biochemistry, analytical chemistry, physical chemistry; matter, mass , energy; Scientific Method, observation, hypothesis, test, evaluation of results, conclusion, theory, law, fact; states of matter, solid, liquid, gas, plasma; substance, mixture, element, compound, heterogenous mixture, homogeneous mixture, solution, solute, solvent; physical properties, physical changes, chemical properties, chemical changes, chemical reactions, reactant, product; Law of Conservation of Mass; potential energy, kinetic energy, Law of Conservation of Energy.

**Key Objectives/Concepts: (What you should know and/or be able to do)**

• The procedures and equipment related to lab safety.

• The definitions of the terms listed above. :

• The steps in the scientific method.

• Be able to identify and describe the use of various pieces of lab equipment commonly used in the chemistry laboratory,

• Describe the actions to be taken in the event of a lab accident.

• Distinguish between physical and chemical properties.

• Be familiar with the major subdivisions of chemistry , be able to deduce which subdivision might apply to a specific question.

• Use the Periodic Table to determine symbols or names of elements, and elements contained in compounds.

• Describe the characteristics of each of the three states of matter.

\* Distinguish between physical properties and chemical properties

• Distinguish between physical changes and chemical changes.

• Distinguish between substances and mixtures.

• Distinguish between solution, solvent and solute.

• Distinguish between homogeneous and heterogeneous mixtures.

• Apply the Law of Conservation of Mass in simple scenarios.

• Apply the Law of Conservation of Energy in simple scenarios.

• Apply the scientific method of problem solving to everyday types of problems.

Related Lab Activities:

* The Candle Lab
* Properties and Changes Lab
* Evaluation methods for Unit:

Lab safety test, unit quizzes, laboratory reports, unit assessment/test

**Unit Two: Scientific Measurement (textbook Chapter 3 and Keynote Unit 2)**

**Key Terms/vocabulary:** be able to define, distinguish and/or use the following terms: qualitative, quantitative, precision, accuracy, percent error, S.I. measurements, micro-, milli-, centi-, deci-, kilo-, mega; length, mass, volume, temperature, Kelvin, Celsius, absolute zero, density, specific gravity, percent error

**Key Objectives/Concepts:**

- be able to distinguish between qualitative and quantitative measurements

- be able to distinguish between accuracy and precision in measurements

- be able to record measurements using significant figures in laboratory situations

* know the rules of significant figures; be able to identify sig. figs. in data; be able to do calculations involving measurements (add’n/ sub’n versus mult./div.)
* know the basic, common units of S.I. measurement as covered in class; know the metric prefixes (meanings and conversion factors); be able to convert between Kelvin and Celsius temperatures; know that Kelvin is the true measure of the kinetic energy for matter.
* understand the relationship between properties of water and the metric units of length, mass and volume (i.e. understand “the cube”
* be able to use sample lab data to calculate the percent error

**Related Lab Activities:**

* Measurement and Sig.Figs.
* Density Determination
* Thickness of Aluminum Foil

**Evaluation Methods for Unit:**

Test on significant figures, unit quizzes, laboratory reports, unit assessment/test

**Unit Three: History of Atom, Atomic Structure, Atomic Models and the Periodic Table and its Trends**

**Key Terms/vocabulary (and Names):**

**3A:** **(History of the Atom)** Democritus, Dalton, Thomson, Rutherford, Bohr; atom, proton, neutron, electron, cathode ray, canal ray, gold foil experiment, alpha particles

**3B**: (**Basic Atomic Structure)** a.m.u, atomic number, Z, Mass Number, A, isotope, atomic mass, Protium, Deuterium, Tritium

**3C**: **(Development of Atomic Models)** Scientific Model, Thomson, Rutherford, Bohr, Schrodinger; plum pudding, planetary models; energy level, ground state, quantum, quantum leap, excited state, photon; incandescent lights, fluorescent lights, “neon” lights; spectroscopy; wave characteristics, crest, trough, origin, amplitude, wavelength, frequency;

**3D**: **(Focus on the Quantum Mechanical Model)** probablility, 2n2, quantum numbers, ZIP code; , n, l, m, s; energy levels, energy sublevels; atomic orbitals, electron spin; spherical, dumbbell, clover, wicked complex; electron configuration, Aufbau Principle, Pauli Exclusion Principle, Hund’s Rule, the “bus seat” rule, diagonal filling pattern

**3E**: **(the Periodic Table and its Trends)** Mendeleev, Moseley; Periodic Law, period, group, family, representative elements, transition metals, inner transition metals, metals, nonmetals, metalloids, Alkali Metals, Alkali Earth Metals, Halogens, Noble Gases, Lanthanide Series, Actinide Series, transuranics; Atomic Size, Ionization Energy, Electron Affinity, Electronegativity; shielding electrons, valence electrons, electron-dot diagrams.

**Objectives/Concepts**:

**3A: (based on textbook section 4-1 and Keynote lesson 3A)**

* Know the names and accomplishments of the historical figures related to our basic knowledge of the atom

**3B**: **(based on testbook section 4-2 and Keynote lesson 3B)**

* Be able to identify and calculate the number of protons, neutrons and electrons for any isotope of any element and to correctly name isotopes
* Be able to calculate the atomic mass of any element from the relative natural abundance and the isotopic masses for that element

**3C**: **(based on textbook section 5-1 and Keynote lesson 3C)**

* Be able to draw Bohr models for any isotope of the elements Z=1 to Z= 20
* Be able to use the ideas proposed by Bohr to explain the role of lights and in flame test (hints: “up and down the ladder” lesson)
* You are responsible for procedure and results from the “flame tests” lab and the “spectroscopy” activity.

**3D**: **(based on textbook section 5-2, 5-3 and Keynote lesson 3D)**

* Be able to correctly fill in an electron configuration diagram.
* Be able to use the electron config. diagram to write the electron configuration for any element and to identify any element by its configuration.
* Be able to use the electron config. diagram to write the set of four quantum numbers for any element and to identify an element by its quantum numbers.

**3E**: **(based on textbook sections 6-1, 6-2 and 6-3 and Keynote lesson 3E)**

* Know ALL the parts of the periodic table as described in class.
* Be able to predict properties for elements using the periodic and group trends (lab: Predicting #40; Lab: Density as a group trend)
* Know all the periodic and group trends described in class; know both how they change and why the change down a group and across a period.
* Be able to organize elements according to various periodic and group trends.
* Be able to write electron dot diagrams for any Representative Element.

**Related Lab Activites:**

* Flame Tests
* Emmision Spectroscopy
* Modern Mendeleev
* Density as a Group Trend

**Related Project: “Adopt an Element” project**

**Evaluation Methods for this Unit:**

Unit quizzes, unit subtests (on 3A/B, on 3C/D and on 3E); student projects, laboratory reports, unit assessment/test

(Note: mid-year exam will cover Units One, Two and Three)

**Unit Four: Nuclear Chemistry and Radiation (textbook Chapter 25 and Keynote Unit 4)**

**Key Terms/vocabulary (and names and places):** radiation; radioisotope; electromagnetic radiation, atomic particle radiation, ionizing radiation, non-ionizing radiation; radio, micro, IR,ROYGBIV,UV,X,Gamma; alpha, beta, gamma; penetrating power; Geiger Counter; decay rxns; Neutron:Proton ratio; 1.50; heavy metals; transuranium elements; half-life, T1/2, carbon-14 dating, Xf = Xi/2n where n = Tt/T1/2 ; transmutation rxns; nuclear fission, neutron bombardment, chain rxn, uncontrolled fission; controlled fission; nuclear power; neutron moderation; neutron absorption; T.M.I; Chernobyl, Fukushima; Yucca Mountain, Carlsbad, NM; nuclear fusion; Manhattan Project, Los Alamos, Oak Ridge, Fat Man, Little Boy, Hiroshima, Nagasaki, Enola Gay

**Objectives/ Concepts**

- know the two main types of radiation; know the electromagnetic spectrum; know atomic particle radiation

- be able to compare and contrast electromagnetic radiation with atomic particle radiation; be able to compare and contrast alpha, beta and gamma in terms of what they are, how they are alike; how they differ (penetrating ability);

- be able to write/complete simple radioactive decay rxns (alpha and beta).

- be able to explain why some isotopes are more stable than others and how nuclear stability if related to radioactice decay.

- know what half-life means and how it is used to date artifacts; be able to solve half-life problems.

- be able to write and/or complete transmutation rxns for various isotopes.

- know the process of nuclear fission and nuclear power: What causes fission? What is fission used for? Controlled vs. uncontrolled fission. How is nuclear fission controlled? What is nuclear power and how does it work? What are the advantages and disadvantages of nuclear power?

- know the process of nuclear fusion: what is it? Where does it occur? What are future possibilities for nuclear fusion?

- know the basic history of the Manhattan Project: key scientists, discoveries and results.

**Related Lab Activities:**  No specific labs, instead, multiple teacher demos.

**Related Activity**: Research on nuclear power as an alternative, editorial on a “theoretical” nuclear plant to be built in our town; follow-up “town meeting”/debate on this “theoretical” power plant.

**Evaluation Methods for this Unit:**

Unit quizzes, Lab reports, Editorial assignment, participation in debate, unit assessment/test

**Unit Five: Chemical Compounds; categories, properties, nomenclature (textbook chapters 7, 8, 9 and 22)**

**Key Terms/vocabulary**: ionic compound, molecular compound, salt, ionic bond, covalent bond, formula unit, molecule, 1.67, cation, anion, binary ionic, ternary ionic, acid, base, hydrate, diatomic molecule, V.S.E.P.R. theory, coordinate covalent bond, polarity, polar bond, non-polar bond, polar molecule, non-polar molecule, dipole, “like dissolves like”, intermolecular forces, van der waal’s forces, hydrogen bonds, binary molecular compounds, alkanes, CnH2n+2 , benzene, substitutedhydrocarbons.

**Objectives/Concepts:**

* Be able to predict a compound as being either ionic or molecular based on its electronegativity values.
* Be able to compare and contrast the properties and characteristics of ionic compounds and molecular compounds.

- Know the diatomic molecules (seven of them) and their structures.

* Be able to draw molecular compounds showing single, double and/or triple covalent bonds.
* Be able to determine polarity for molecular compounds: polar vs non-polar bond, polar vs non-polar molecules, positive and negative dipoles.
* Understand the concept of “like dissolves like” as it applies to polarity of molecules.
* Understand intermolecular forces and the role they play in the properties of compounds.
* Be able to write correct formulas and/or name each of the following kinds of inorganic compounds: binary ionic, ternary ionic, acids and binary molecular.
* Be able to write formulas, name, and/or draw each of the 10 organic alkanes and benzene (and substituted hydrocarbons).

**Related Lab Activites:**

* Differences between ionic and molecular compounds
* Composition of hydrates

**Evaluation Methods for this Unit:**

Unit quizzes, test on ionic compounds, laboratory reports, unit assessment/test

**Unit Six: CHEMICAL REACTIONS (Textbook Chapter 11)**

**Key Terms/Vocabulary:**

Chemical change, chemical reaction, reactants, products, chemical equation, skeleton equation, coefficients, Law of Conservation of Matter, balanced equation; combination reaction (rxn), decomposition rxn, single-replacement rxn, Activity Series, double-replacement rxn, precipitate, complete combustion, incomplete combustion.

**Objectives/Concepts:**

**\*** be able to write skeleton equations for reactions and interpret skeleton equations into “word equations”

• be able to write and balance chemical equations for rxns.

• be able to classify rxns.

• be able to predict products for rnns based on their classifications

• be able to observe and/or “run” a variety of chemical reactions in the laboratory' setting; be able to classify those rxns and write a complete balanced equation induding all necessary formulas and symbols.

**Related Laboratory Experiences:**

* Calculating % copper in a Single-Replacement Reaction
* Summary of Reactions lab activity

**Evaluation Methods for this Unit:**

Skills Test on skeleton equations and basic balancing, unit quizzes, laboratory reports, unit assessment/test.

**Unit Seven: Chemical Quantities and the Mole Concept (textbook chapter 10)**

**Key terms/vocabulary:**

Mole, Avogadro's Number, Atomic particles (atoms, molecules, formula units) Molar Mass, Molar Volume, Percent Composition

**Concepts/Objectives:**

* Students will prepare for mole conversion by mastering the “factor-label” method to solve simple one step and mult-step (non-chemistry) conversions (involving things like time and money)

• be able to perform one and two step molar conversions for particles, mass and volume (understanding the “mole triangle” aka “the mole map”

• be able to calculate the percent compositon for any compound.

• be able to calculate the empirical and molecular formulas for unknown compounds

• be able to solve lab practical problems related to the mole concept

**Related Lab Activities:**

* How Big is Avogodro’s Number (the Pea-Bean lab)
* Mole Calculations Lab Activity

**Evaluation Methods for this Unit:**

Skills test on using factor-label method, unit quizzes, laboratory reports, unit assessment/test (often it is more of a lab practical assessment)

**Unit Eight: Stoichiometry (textbook Chapter 12)**

**Key Terms/Vocabulary:**

Stoichiometry, Actual Yield, Theoretical Yield, Percent Yield

**Concepts/Objectives**

• be able to write and correctly balance an equation for a chemical reaction (should’ve already mastered this)

• be able to do calculations for mole,mole, mass,mass, mass,volume, and volume,volume problems.

• be able to solve percent yield problems for a chemical rxn and explain the percent yield results for the reaction

• apply their Stoichiometry skills to a variety of laboratory activities.

**Related Lab Activites**:

* Mole relationship in a chemical reaction (mole-mole)
* Calculating percent yield for the production of MgO (mass-mass/%yield)

Evaluation Methods for this Unit:

Skills test on using stoichiometry “four box” set-up of problem solving; quizzes; unit assessment/test (often the unit assessment is a lab practical)

**TEXTBOOK:** Chemistry, Wilbraham et al, Prentice Hall, 2008

**Other sources:** catchem.wikispaces.com (handouts, keynotes, blogs